

Claims

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1. An imaging system (1) for imaging a non-planar developable surface (30), the system (1) comprising a processor (25) linked to an image capture means (2) and being capable of: capturing at least one image (31,33) of the surface (30), said image (31,33) having a warp corresponding to the non-planar surface; and of generating therefrom a first set of points (95) representing the three-dimensional profile of the non-planar surface relative to a planar reference surface (12), characterised in that the processor (25) is arranged to fit to the first set of points (95) a second set of points (117) representative of a developable mesh (110) and to use the second set of points (117) to texture-map the image (150,154,160) in order to de-warp the image (32).

2. A method of imaging a non-planar developable surface (30) using an imaging system (1) comprising a processor (25) linked to an image capture means (2), comprising the steps of:

i) capturing at least one image (31,33) of the surface (30), said image having a warp corresponding to the non-planar surface (30);

ii) generating from the image (31,33) a first set of points (95) representing the three-dimensional profile of the non-planar surface (30) relative to a planar reference surface (12);

characterised in that the method comprises the steps of:

iii) fitting to the first set of points a second set of points (117) representative of a developable mesh (110); and

iv) using the second set of points (117) to texture-map (150,154,160) the image (31,33) in order to de-warp the image.

5 3. A method as claimed in Claim 2, in which in step iii) the mesh (133) is distorted as the second set of points (117) is fit to the first set of points (95) to the extent that the mesh (133) is no longer developable, following which the distorted mesh (133) is relaxed (140) to a developable state.

15 4. A method as claimed in Claim 3, in which prior to step iii) an initial surface (130) is fit to the first set of points, and in step iii) the mesh (133) is fit to the initial surface (130).

20 5. A method as claimed in Claim 4, in which the initial surface (130) is a developable surface, and in which after fitting of the mesh (133) to the initial surface (130) at least some of the second set of points (117) are moved (132) closer to corresponding ones of the first set of data (95) points during which the mesh (133) is distorted.

25 6. A method as claimed in any of Claims 3 to 5, in which points (134) in the second set of points are not fit to the first set of points (95) if said points (134) in the second set of points do not correspond closely enough to any of the points in the first set of points (95).

30 7. A method as claimed in any of Claims 3 to 6, in which the relaxation of the mesh (140) takes place in an iterative process in which the second set of points (117) is adjusted incrementally until distances between points in the second set of points are equalized.

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8. A method as claimed in any of Claims 2 to 7, in which the non-planar developable surface is a curled document (30).

5 9. A method as claimed in Claim 8, in which the extent of the document (30) is estimated by fitting a rectangle (124) around extreme points (126,128) of the first set of points (95).

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10 10. A method as claimed in Claim 8 or Claim 9, in which the image capture means (2) projects a structured light pattern (26) that forms separated light stripes (35) across the non-planar developable surface (30), the first set of points (95) being generated from the light stripes (35).

15 11. A method as claimed in Claim 10, in which step ii) includes the steps of:

a) creating a difference image by taking a difference
20 between an image captured with the stripes (33) and an image captured without the stripes (31);

b) thresholding the difference image to discard portions below a threshold;

25 c) counting detected stripes across the difference image in order to identify individual stripes (35);

d) triangulating (84) the image of the non-planar surface
30 at points (86) corresponding with identified stripes (35) to generate the first set of points (95).